



Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Tom Kawa

November 2, 2018

Dear Mr. Kawa,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on October 1st, 2018. This is your fourth quarter 2018 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill St., West Warwick, RI 02893

(401) 353-3420

TOXICOLOGICAL EVALUATION
AND CHEMICAL ANALYSES
OF EFFLUENT:
NPDES Permit # MA0100633
Fourth Quarter 2018 Sample
Lowell

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

November 2, 2018

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, Rhode Island 02893

NETLAB CASE NUMBER: 8J01003



New England Bioassay

A Division of GZA



NEW ENGLAND BIOASSAY A DIVISION OF GZA CHRONIC AQUATIC TOXICITY TEST REPORT

Permittee: Lowell RWWU NPDES # MA0100633
Report submitted to: New England Testing Laboratories
59 Greenhill Street, West Warwick RI
Sample ID: Effluent
Test Month/Year: October 2018
NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater
Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 9/30-10/1/18 #2 10/2-3/18 #3 10/4-5/18

Test Start Date: 10/2/18

Results Summary

Your results were as follows:

Passed all permit limits

Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
<i>Ceriodaphnia dubia</i>	>100%	100%	≥ 100%	Pass

Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
<i>Ceriodaphnia dubia</i>	100%	>100%	>100%	N/A	N/A

Data Qualifiers affecting this test:

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

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Test Report Certification

Permittee name: Lowell RWWU Permit number: MA0100633
Client sample ID: Effluent Test Start Date: 10/2/18

Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____
(Date)

Authorized Signature

Print or Type Name and Title

Print or Type the Permittee's Name

MA0100633

Print or Type the NPDES Permit Number

Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____

11/1/18
(Date)

Kimberly Wills

Laboratory Manager

New England Bioassay a division of GZA

General Test Conditions

Permittee name: Lowell RWWU Permit number: MA0100633
Client sample ID: Effluent Test Start Date: 10/2/18

Sample Collection Information

Effluent #1 Dates/Times: 9/30-10/1/18 @ 0700-0700 Receiving Water #1 Date/Time: 10/1/18 @
Effluent #2 Dates/Times: 10/2-3/18 @ 0700-0700 Receiving Water #2 Date/Time: 10/3/18 @ 0740
Effluent #3 Dates/Times: 10/4-5/18 @ 0700-0700 Receiving Water #3 Date/Time: 10/5/18 @ 0730

Were a minimum of three samples collected? Yes ☒ No ☐ *(see note below)

Were samples used within the first 36 hours of collection? Yes ☒ No ☐ *(see note below)

* sample collection note:

Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO₃)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☒ Yes ☐ with Instant Ocean sea salts to ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Dechlorination was not required

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

Reference Toxicant Data

Ceriodaphnia dubia

Date: 10/15/18
Toxicant: Sodium chloride
Dilution Water: NEB CTRMH
Organism Source: NEB
Reproduction IC25: 0.95 g/L
Results within range Yes ☒ No ☐

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 10/2/18 - 10/10/18

Test Acceptability Criteria

Lab Diluent Survival: 90 % Mean Lab Diluent Reproduction: 18.4 young per female

River Control Survival: 80 % Mean River Control Reproduction: 30.0 young per female

Thiosulfate Control Survival: N/A % Mean Thiosulfate Control Reproduction: N/A young per female

Presence of an asterisk (*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Results

		Permit Limit	Test Result	Pass/Fail Status
Acute Data	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
Chronic Data	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		100%	
	Reproduction C-LOEC		>100%	
	Reproduction IC25		>100%	
	Reproduction IC50		>100%	
	Reportable C-NOEC		100%	
	Reportable C-LOEC		>100%	
	MATC		>100%	
	TUc			

Presence of an asterisk (*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Variability

Reproduction PMSD: 47.0% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☒ Within bounds ☐ High

☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)

☒ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.

☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.

☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.

☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.

☐ No statistically significant reductions were observed in this test.

***Ceriodaphnia dubia* Test Results**

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 10/2/18 - 10/10/18

Concentration - Response Evaluation

Survival: #12 No significant effects at any test concentration with a flat concentration-response curve. Test concentrations performed very similarly to dilution control.

Reproduction: #13 No significant effects at any test concentration with a relatively flat concentration-response curve. Test concentrations performed equal to or better than the dilution control.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
<u>X</u>	<u>X</u>	Results are reliable and reportable
<u> </u>	<u> </u>	Results are anomalous (see explanation below)
<u> </u>	<u> </u>	Results are inconclusive - retest (see explanation below)

Results Discussion (if applicable):

TEST METHODS

Ceriodaphnia dubia

Test type:	Modified Chronic Static Renewal Freshwater Test
Test Reference Manual:	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
Test Method:	<i>Ceriodaphnia dubia</i> Survival and Reproduction Test - EPA 1002.0
Temperature:	25 °C ± 1°C (Temperatures should not deviate by more than 3°C during the test) (required)
Light Quality:	Ambient Laboratory Illumination (recommended)
Light Intensity:	10-20 µE/m ² /s, or 50-100 ft-c (recommended)
Photoperiod:	16 hours light, 8 hours dark (recommended)
Test chamber size:	30 mL (recommended minimum)
Test solution volume:	15 mL (recommended minimum)
Renewal of Test Solutions:	Daily (required)
Age of Test Organisms:	Less than 24 hours; and all released within a 8-h period (required)
Number of Neonates Per Test Chamber:	1 Assigned using blocking by known parentage (required)
Number of Replicate Test Chambers Per Treatment:	10 (required minimum)
Number of Neonates Per Test Concentration:	10 (required minimum)
Feeding Regime:	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
Cleaning:	Use new plastic cups daily (recommended)
Aeration:	None (recommended)
Test Duration:	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
Endpoints:	Survival and reproduction (required)
Test Acceptability:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
Sampling Requirements:	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
Sample volume required:	1 L/Day (recommended)

CERIODAPHNIA DUBIA DATASHEETS & STATISTICAL ANALYSIS

NEW ENGLAND BIOASSAY TOXICITY DATA FORM

CHRONIC COVER SHEET

CLIENT: New England Testing Laboratories
 ADDRESS: 59 Greenhill Street
West Warwick, RI 02893
 PERMITTEE: Lowell RWWU
 PERMIT NUMBER: MA0100633
 DILUTION WATER: Laboratory Soft Water

C.dubia TEST ID # 18-1474
 CHAIN OF CUSTODY # C38-3732/33
 NEB PROJECT # 05.0044476.00
 SAMPLE ID: Effluent

INVERTEBRATES

TEST SET-UP TECHNICIAN: TBP
 TEST SPECIES: *Ceriodaphnia dubia*
 NEB LOT # Cd18(RMH 229)
 AGE: < 24 hours
 TEST SOLUTION VOLUME (mls): 15
 ORGANISMS PER TEST CHAMBER: 1
 ORGANISMS PER CONCENTRATION: 10

LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L CaCO ₃	Alkalinity mg/L CaCO ₃
C38-S022	48	35

	DATE	TIME
TEST START:	10/2/18	1634
TEST END:	10/10/18	1435

COMMENTS: _____

REVIEWED BY:  DATE: 11/1/18

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS: Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850				
NEB PROJECT NUMBER: 05.0044476.00		NEB TEST NUMBER: 18-1474		COC # C38-3732/33
TEST ORGANISM: <i>Ceriodaphnia dubia</i>		AGE: <24 hours		Lot # Cd18(RMH 229)
START DATE: 10/2/18	TIME: 1634	END DATE: 10/10/18	TIME: 1435	

Effluent Concentration	Culture Lot# Cd18(RMH 229)											Total Live Young	# Live Adults	Analyst- Transfer	Analyst- Counts
	Cup #	A1	A5	A6	A8	A10	B2	B4	B8	B12	B13				
	Day Number	Replicate													
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	TBP	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	PD	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	MM	MM
	4	✓	5	6	✓/x	5	4	7	3	8	5	43	9	CW	CW
	5	3	8	✓	X	3	2	9	11	10	9	55	9	KO	KO
	6	3	✓	2	X	✓	2	✓	13	✓	8	28	9	PD	PD
	7	6	10	✓	X	8	9	9	8	10	3	55	9	TBP	TBP
	8	✓	✓	3	X	✓	✓	✓	8	✓	✓	3	9	MM	MM
	totals	12	23	11	0	16	17	25	27	28	25	184	9		MC
Merrimack River Control		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	6	7	3	6	6	6	6	7	6	58	10		
	5	11	10	15	13	12	14	13	10	9	12	119	10		
	6	20	14	13	✓	✓	19	1	11	✓	9	87	10		
	7	8	4	4	✓/x	6	9	✓/x	18	7	6	36	8		
	8	✓	✓	✓	X	✓	✓	X	✓	✓	✓	0	8		
	totals	36	34	39	16	24	48	20	27	23	33	300	8		
6.25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	✓	6	6	5	5	2	3	6	✓	1	34	10		
	5	13	11	12	9	9	13	2	9	12	10	100	10		
	6	14	3	4	3	10	4	2	2	✓	5	47	10		
	7	9	10	✓	19	5	13	✓/x	7	16	3	82	9		
	8	15	3	21	19	16	18	X	15	✓	✓	39	9		
	totals	36	33	43	36	29	32	7	39	28	19	302	9		

Notes: Replicates in which the neonates are marked with a strike are judged to contain 4th broods (rather than split-broods), and the 4th brood is not included in the reproduction totals per EPA-821-R-02-013.

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS: Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850
 NEB PROJECT NUMBER: 05.0044476.00 ORGANISM: *Ceriodaphnia dubia* START DATE: 10/2/18

Effluent Concentration	Day Number	Replicate										Total Live Young	# Live Adults		
		A	B	C	D	E	F	G	H	I	J				
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	✓	7	7	6	5	✓	✓	3	7	7	42	10		
	5	10	11	10	15	6	13	12	13	14	9	113	10		
	6	13	6	4	7	20	19	11	1	✓	6	87	10		
	7	✓	✓/x	7	2	3	4	9	16	13	15	69	9		
	8	9	X	16	19	18	✓	✓/x	17	15	13	9	8		
	totals	32	24	28	30	34	36	32	33	34	37	320	8		
25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	7	7	5	6	5	5	✓	5	3	✓	43	10		
	5	14	14	15	10	12	14	10	13	6	10	118	10		
	6	4	11	5	7	3	13	4	13	16	6	82	10		
	7	3	6	6	6	14	7	✓	14	7	7	56	10		
	8	3	✓	✓/x	✓	4	14	✓	✓	✓	✓	7	9		
	totals	31	38	31	29	38	39	14	31	32	23	306	9		
50%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	6	6	9	8	6	✓	✓	6	✓	6	47	10		
	5	12	9	2	14	13	11	✓	✓	11	12	84	10		
	6	5	13	5	9	3	1	11	1	✓	✓	48	10		
	7	5	10	✓/x	9	3	15	11	11	16	9	79	9		
	8	✓	✓	X	✓	8	9	15	8	11	3	54	9		
	totals	28	28	16	40	33	36	37	26	38	30	312	9		
100%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	✓	6	6	8	6	3/x	6	✓	6	5	46	9		
	5	13	12	5	13	10	X	13	11	12	11	100	9		
	6	21	8	16	4	7	X	3	6	13	7	85	9		
	7	7	12	6	3	10	X	9	9	12	15	71	9		
	8	8	11	✓	✓	16	X	5	9	✓	✓	14	9		
	totals	41	38	33	28	33	3	36	35	31	38	316	9		

CETIS Analytical Report

Report Date: 22 Oct-18 10:55 (p 1 of 6)
Test Code/ID: 18-1474 / 11-6084-8346

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 15-7797-3607	Endpoint: 2d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-18 10:54	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 11-7260-4996	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 02 Oct-18 16:34	Protocol: EPA/821/R-02-013 (2002)	Diluent: Receiving Water
Ending Date: 10 Oct-18 14:35	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 22h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 09-1234-8408	Code: 366154F8	Project:
Sample Date: 01 Oct-18 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 01 Oct-18 16:30	CAS (PC):	Station:
Sample Age: 34h	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1386946	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

2d Survival Rate Detail

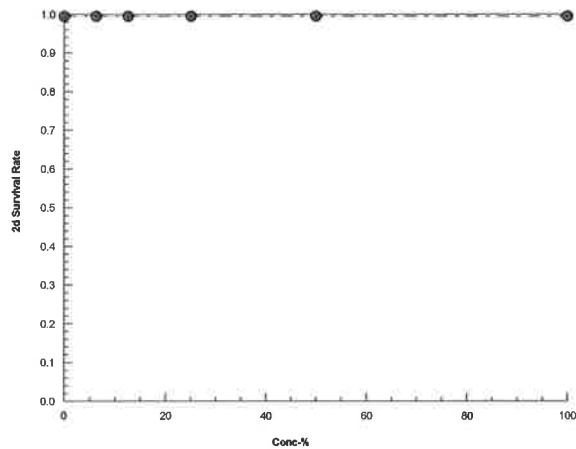
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 15-7797-3607	Endpoint: 2d Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 22 Oct-18 10:54	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

Graphics



CETIS Analytical Report

Report Date: 22 Oct-18 10:55 (p 3 of 6)
Test Code/ID: 18-1474 / 11-6084-8346

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 18-6055-0937	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-18 10:54	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 11-7260-4996	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 02 Oct-18 16:34	Protocol: EPA/821/R-02-013 (2002)	Diluent: Receiving Water
Ending Date: 10 Oct-18 14:35	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 22h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 09-1234-8408	Code: 366154F8	Project:
Sample Date: 01 Oct-18 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 01 Oct-18 16:30	CAS (PC):	Station:
Sample Age: 34h	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1148434	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9	0.8	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

7d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B)							Isotonic Variate	
			Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9	0.0%
6.25		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.9	0.0%
12.5		10	0.8000	0.0000	1.0000	0.4216	52.70%	11.11%	8/10	0.875	2.78%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.875	2.78%
50		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.875	2.78%
100		10	0.9000	0.0000	1.0000	0.3162	35.14%	0.0%	9/10	0.875	2.78%

7d Survival Rate Detail

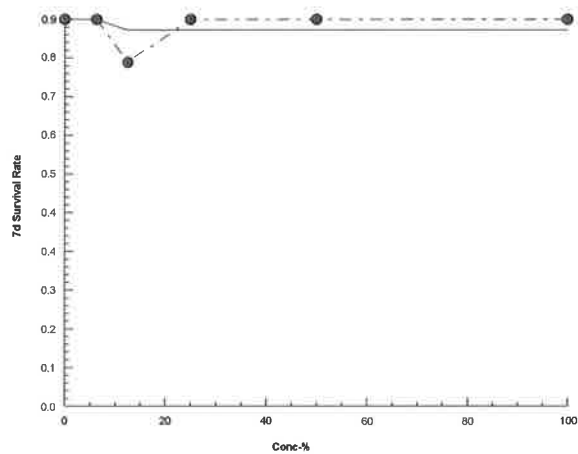
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
12.5		1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000

7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay
Analysis ID: 18-6055-0937	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 22 Oct-18 10:54	Analysis: Linear Interpolation (ICPIN)	Status Level: 1	

Graphics



CETIS Analytical Report

Report Date: 22 Oct-18 10:55 (p 5 of 6)
Test Code/ID: 18-1474 / 11-6084-8346

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 21-1263-9225	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-18 10:55	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Batch ID: 11-7260-4996	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 02 Oct-18 16:34	Protocol: EPA/821/R-02-013 (2002)	Diluent: Receiving Water
Ending Date: 10 Oct-18 14:35	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 22h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 09-1234-8408	Code: 366154F8	Project:
Sample Date: 01 Oct-18 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 01 Oct-18 16:30	CAS (PC):	Station:
Sample Age: 34h	Client: New England Testing Labs	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1252771	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	18.4	15	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Reproduction Summary

Calculated Variate

Isotonic Variate

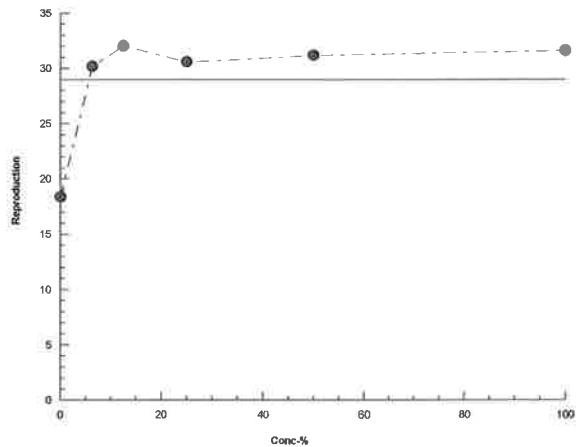
Conc-%	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	Mean	%Effect
0	D	10	18.4	0	28	8.922	48.49%	0.0%	29	0.0%
6.25		10	30.2	7	43	10.49	34.72%	-64.13%	29	0.0%
12.5		10	32	24	37	3.859	12.06%	-73.91%	29	0.0%
25		10	30.6	14	39	7.589	24.80%	-66.3%	29	0.0%
50		10	31.2	16	40	7.177	23.00%	-69.57%	29	0.0%
100		10	31.6	3	41	10.73	33.96%	-71.74%	29	0.0%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	12	23	11	0	16	17	25	27	28	25
6.25		36	33	43	36	29	32	7	39	28	19
12.5		32	24	28	30	34	36	32	33	34	37
25		31	38	31	29	38	39	14	31	32	23
50		28	28	16	40	33	36	37	26	38	30
100		41	38	33	28	33	3	36	35	31	38

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay	
Analysis ID:	21-1263-9225	Endpoint:	Reproduction	CETIS Version: CETISv1.9.4
Analyzed:	22 Oct-18 10:55	Analysis:	Linear Interpolation (ICPIN)	Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 22 Oct-18 10:55 (p 1 of 2)
Test Code/ID: 18-1474 / 11-6084-8346

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 19-7387-3585	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-18 10:54	Analysis: STP 2xK Contingency Tables	Status Level: 1
Batch ID: 11-7260-4996	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 02 Oct-18 16:34	Protocol: EPA/821/R-02-013 (2002)	Diluent: Receiving Water
Ending Date: 10 Oct-18 14:35	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 22h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 09-1234-8408	Code: 366154F8	Project:
Sample Date: 01 Oct-18 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 01 Oct-18 16:30	CAS (PC):	Station:
Sample Age: 34h	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	0.7632	Exact	1.0000	Non-Significant Effect
		12.5	0.5000	Exact	1.0000	Non-Significant Effect
		25	0.7632	Exact	1.0000	Non-Significant Effect
		50	0.7632	Exact	1.0000	Non-Significant Effect
		100	0.7632	Exact	1.0000	Non-Significant Effect

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9	0.8	>>	Yes	Passes Criteria

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	9	1	10	0.9	0.1	0.0%
6.25		9	1	10	0.9	0.1	0.0%
12.5		8	2	10	0.8	0.2	11.11%
25		9	1	10	0.9	0.1	0.0%
50		9	1	10	0.9	0.1	0.0%
100		9	1	10	0.9	0.1	0.0%

7d Survival Rate Detail

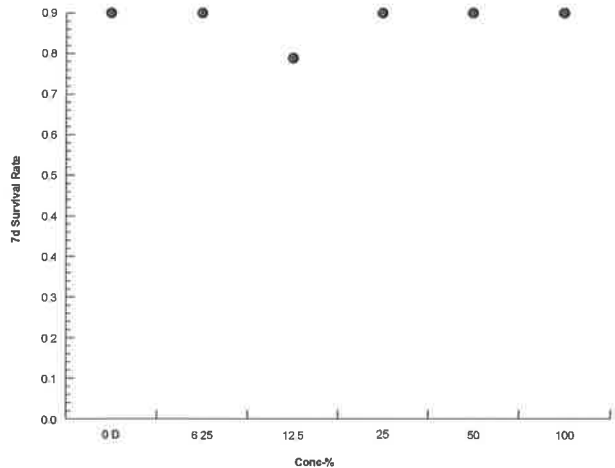
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
12.5		1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000

7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
12.5		1/1	0/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
25		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test		New England Bioassay	
Analysis ID: 19-7387-3585	Endpoint: 7d Survival Rate	CETIS Version: CETISv1.9.4	
Analyzed: 22 Oct-18 10:54	Analysis: STP 2xK Contingency Tables	Status Level: 1	

Graphics



CETIS Analytical Report

Report Date: 22 Oct-18 10:55 (p 1 of 2)
Test Code/ID: 18-1474 / 11-6084-8346

Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID: 00-3156-5633	Endpoint: Reproduction	CETIS Version: CETISv1.9.4
Analyzed: 22 Oct-18 10:55	Analysis: Nonparametric-Control vs Treatments	Status Level: 1
Batch ID: 11-7260-4996	Test Type: Reproduction-Survival (7d)	Analyst:
Start Date: 02 Oct-18 16:34	Protocol: EPA/821/R-02-013 (2002)	Diluent: Receiving Water
Ending Date: 10 Oct-18 14:35	Species: Ceriodaphnia dubia	Brine: Not Applicable
Test Length: 7d 22h	Taxon: Branchiopoda	Source: In-House Culture Age: <24
Sample ID: 09-1234-8408	Code: 366154F8	Project:
Sample Date: 01 Oct-18 07:00	Material: WWTF Effluent	Source: Lowell RWWU (MA0100633)
Receipt Date: 01 Oct-18 16:30	CAS (PC):	Station:
Sample Age: 34h	Client: New England Testing Labs	

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	>100	n/a	1	47.03%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	140.5	75	1	18	Asymp	1.0000	Non-Significant Effect
		12.5	150.5	75	1	18	Asymp	1.0000	Non-Significant Effect
		25	143.5	75	1	18	Asymp	1.0000	Non-Significant Effect
		50	145.5	75	2	18	Asymp	1.0000	Non-Significant Effect
		100	145.5	75	1	18	Asymp	1.0000	Non-Significant Effect

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	18.4	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1369.6	273.92	5	3.834	0.0048	Significant Effect
Error	3858.4	71.4519	54			
Total	5228		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	9.445	15.09	0.0926	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8881	0.9459	5.0E-05	Non-Normal Distribution

Reproduction Summary

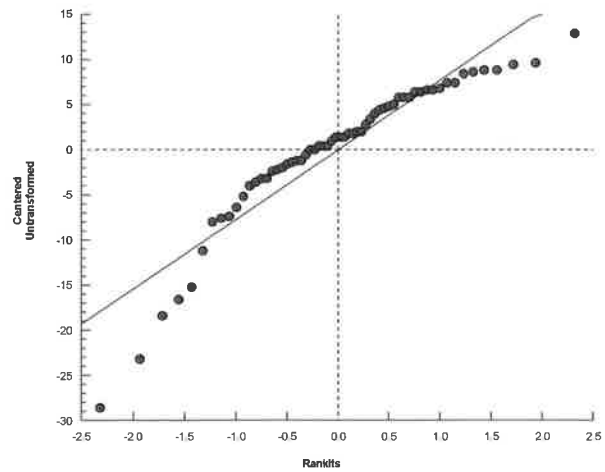
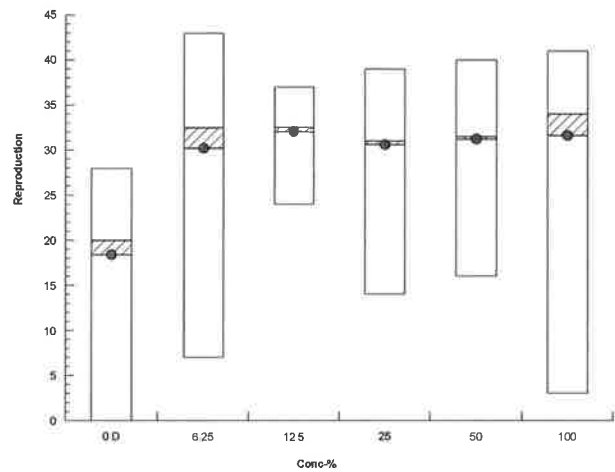
Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	18.4	12.02	24.78	20	0	28	2.821	48.49%	0.00%
6.25		10	30.2	22.7	37.7	32.5	7	43	3.316	34.72%	-64.13%
12.5		10	32	29.24	34.76	32.5	24	37	1.22	12.06%	-73.91%
25		10	30.6	25.17	36.03	31	14	39	2.4	24.80%	-66.30%
50		10	31.2	26.07	36.33	31.5	16	40	2.27	23.00%	-69.57%
100		10	31.6	23.92	39.28	34	3	41	3.393	33.96%	-71.74%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	12	23	11	0	16	17	25	27	28	25
6.25		36	33	43	36	29	32	7	39	28	19
12.5		32	24	28	30	34	36	32	33	34	37
25		31	38	31	29	38	39	14	31	32	23
50		28	28	16	40	33	36	37	26	38	30
100		41	38	33	28	33	3	36	35	31	38

Ceriodaphnia 7-d Survival and Reproduction Test			New England Bioassay	
Analysis ID: 00-3156-5633	Endpoint: Reproduction	CETIS Version: CETISv1.9.4		
Analyzed: 22 Oct-18 10:55	Analysis: Nonparametric-Control vs Treatments	Status Level: 1		

Graphics



NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850						
NEB PROJECT NUMBER:		05.0044476.00		TEST ORGANISM		Ceriodaphnia dubia		
DILUTION WATER SOURCE:		Laboratory Soft Water		START DATE:		10/2/18		TIME: 1634
ANALYST	PD	CD	CD	MM	KO	KO	PD	TBP
NEB Lab Diluent	1	2	3	4	5	6	7	8
Temp °C Initial	26.0	25.2	25.5	24.4	25.0	25.5	25.5	25.5
D.O. mg/L Initial	8.1	8.2	8.1	8.8	8.4	8.4	8.3	8.2
pH s.u. Initial	7.3	7.4	7.5	7.4	7.6	7.6	7.7	7.0
Conductivity µS Initial	185	180	178	183	185	187	187	190
Temp °C Final	25.8	26.0	25.4	25.5	25.5	24.9	25.4	25.5
D.O. mg/L Final	8.3	8.0	8.2	8.2	8.2	8.2	8.0	7.9
pH s.u. Final	7.5	7.7	7.9	7.5	7.7	7.7	7.6	7.8
Conductivity µS Final	188	184	196	193	211	202	195	194
Merrimack River Control	1	2	3	4	5	6	7	8
Temp °C Initial	25.9	25.3	26.0	24.7	25.5	25.6	25.1	25.3
D.O. mg/L Initial	8.4	8.8	9.2	9.2	9.2	8.3	8.8	8.9
pH s.u. Initial	7.3	7.3	7.5	7.3	7.5	7.4	7.5	7.0
Conductivity µS Initial	155	156	167	167	143	144	144	143
Temp °C Final	25.8	26.0	25.9	25.7	25.5	24.6	25.2	25.6
D.O. mg/L Final	8.6	8.4	8.5	8.3	8.5	8.4	8.0	8.0
pH s.u. Final	7.5	8.0	7.8	7.6	7.9	7.6	7.4	7.7
Conductivity µS Final	170	163	180	180	158	162	161	158
6.25%	1	2	3	4	5	6	7	8
Temp °C Initial	25.9	25.5	25.9	24.7	25.5	25.7	25.4	25.6
D.O. mg/L Initial	8.7	8.2	8.1	8.9	8.9	9.2	8.6	8.2
pH s.u. Initial	7.2	7.3	7.6	7.3	7.5	7.6	7.6	7.2
Conductivity µS Initial	224	232	234	239	252	256	248	250
Temp °C Final	25.8	26.0	25.7	25.7	25.5	24.8	25.3	25.5
D.O. mg/L Final	8.7	8.4	8.7	8.3	8.6	8.6	8.3	8.2
pH s.u. Final	7.5	7.9	8.2	7.7	8.0	8.2	7.5	7.8
Conductivity µS Final	234	236	243	255	260	276	260	260
12.5%	1	2	3	4	5	6	7	8
Temp °C Initial	26.0	25.5	26.0	24.0	25.2	25.7	25.3	25.6
D.O. mg/L Initial	8.2	8.2	8.1	9.0	8.6	8.4	8.4	8.2
pH s.u. Initial	7.3	7.4	7.6	7.3	7.6	7.7	7.6	7.2
Conductivity µS Initial	274	278	280	290	313	311	329	316
Temp °C Final	25.9	26.0	25.8	25.8	25.6	24.7	25.2	25.5
D.O. mg/L Final	8.7	8.6	8.8	8.5	8.8	8.8	8.4	8.3
pH s.u. Final	7.5	8.0	8.2	7.7	8.1	8.2	7.6	7.9
Conductivity µS Final	283	280	289	309	322	340	338	321

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:		Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:		05.0044476.00			TEST ORGANISM		Ceriodaphnia dubia		
DILUTION WATER SOURCE:		Laboratory Soft Water			START DATE:		10/2/18	TIME: 1634	
25%		1	2	3	4	5	6	7	8
Temp °C	Initial	26.0	25.4	26.0	24.0	25.2	25.8	25.3	25.5
D.O. mg/L	Initial	8.2	8.2	8.2	8.9	8.5	8.4	8.4	8.2
pH s.u.	Initial	7.3	7.5	7.6	7.4	7.6	7.6	7.6	7.2
Conductivity µS	Initial	379	398	392	413	436	447	435	457
Temp °C	Final	25.8	26.0	25.9	25.9	25.6	24.6	25.2	25.4
D.O. mg/L	Final	8.8	8.6	8.8	8.5	8.8	8.9	8.5	8.4
pH s.u.	Final	7.9	8.1	8.3	7.7	8.1	8.3	7.7	8.0
Conductivity µS	Final	384	397	400	421	441	461	447	457
50%		1	2	3	4	5	6	7	8
Temp °C	Initial	26.0	25.5	26.0	24.1	25.2	25.9	25.2	25.5
D.O. mg/L	Initial	8.3	8.3	8.4	8.9	8.6	8.4	8.6	8.3
pH s.u.	Initial	7.3	7.4	7.5	7.3	7.5	7.5	7.5	7.3
Conductivity µS	Initial	592	595	623	621	705	715	707	715
Temp °C	Final	25.9	26.0	25.9	25.9	25.6	24.7	25.3	25.4
D.O. mg/L	Final	8.9	8.7	9.0	8.6	8.7	9.0	8.4	8.5
pH s.u.	Final	8.0	8.1	8.2	7.8	8.1	8.3	7.8	8.1
Conductivity µS	Final	592	586	632	617	712	722	711	704
100%		1	2	3	4	5	6	7	8
Temp °C	Initial	25.9	25.3	26.0	24.8	25.3	26.0	24.9	25.4
D.O. mg/L	Initial	8.5	8.4	9.2	8.9	8.7	8.4	8.8	8.5
pH s.u.	Initial	7.2	7.3	7.3	7.2	7.3	7.3	7.4	7.2
Conductivity µS	Initial	1,022	1,014	1,072	1,076	1,231	1,242	1,234	1236
Temp °C	Final	25.9	26.0	25.9	25.9	25.6	24.7	25.3	25.5
D.O. mg/L	Final	8.9	8.7	8.9	8.6	8.9	9.0	8.4	8.6
pH s.u.	Final	8.1	8.1	8.1	7.8	8.2	8.3	8.0	8.1
Conductivity µS	Final	1,008	991	1,058	1,090	1,219	1,323	1,234	1220
		1	2	3	4	5	6	7	Remarks
Temp °C	Initial								
D.O. mg/L	Initial								
pH s.u.	Initial								
Conductivity µS	Initial								
Temp °C	Final								
D.O. mg/L	Final								
pH s.u.	Final								
Conductivity µS	Final								

Table of Random Permutations of 16

C.dubia Test ID#

18-1474

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
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2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
10	15	2	1	13	12	16	3	4	8	10	1	15	5	14	12	14	12	3	2
12	10	7	12	9	11	9	8	12	14	15	4	11	8	16	8	9	14	14	1
15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
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5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
concreps																			
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
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16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
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13	16	9	1	1	8	10	9	9	4	1	16	2	3	8	14	1	10	6	10
1	6	7	4	8	6	5	2	8	15	4	6	6	1	4	5	7	13	2	10
9	15	11	3	11	15	9	10	1	3	8	2	15	7	9	8	16	1	14	3
10	16	4	5	12	9	16	11	7	1	7	16	11	8	3	3	12	2	3	4
4	14	1	9	5	5	4	13	6	8	15	5	12	5	7	16	5	11	8	1
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8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

Brood mother source: RMH 224 A-8 Source's brood size: 21 (Qty.)

Lowell 10.2-18

Tech	At	At	At	At		At	At	At								
Date	9.25	9.26	9.27	9.28		9.30	10.1	10.2								
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup #																
1	N	N	N	4		2Y	Y	Y T1 13	1							
2	N	N	N	5		7	Y	N	2							
3	N	N	N	6		8	Y	N	3							
4	N	N	N	6		9	Y	N	4							
5	N	N	N	5		8	Y	Y T2 15	5							
6	N	N	N	7		9	Y	Y T3 14	6							
7	N	N	N	6		9	Y	N	7							
8	N	N	N	5		10	Y	Y T4 13	8							
9	N	N	N	4		10	Y	Y	9							
10	N	N	N	6		8	Y	Y T5 16	10							
11	N	N	N	6		10	Y	N	11							
12	N	N	N	6		9	Y	N	12							
13	N	N	N	7		8	Y	N	13							

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A → = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H₂O type used w/ renewal this day.

Test organism collection:

Tray diagram
used?

Project #	Symbols (✓ / P)	(Y/N)	Time period, neonates released	Collection date / time
0044476	T	Y	10.2.18/0600 → 10.2.18/1100	10.2.18/1400
	T			
	T			
	T			
	T			
	T			

Brood mother source: RMH 229 B-10 Source's brood size: 29 (Qty.)

Lowell 10.2.18

Tech	At	At	At	At		At	At	At								
Date	9.25	9.26	9.27	9.28		9.30	10.1	10.2								
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup #																
1	N	N	N	5		8	Y	N	1							
2	N	N	N	6		2Y	Y	T6 Y14	2							
3	N	N	N	6		2Y	Y	N	3							
4	N	N	N	5		9	Y	T7 Y15	4							
5	N	N	N	4		2Y	Y	N	5							
6	N	N	N	6		9	Y	N	6							
7	N	N	N	4		2Y	Y	Y	7							
8	N	N	N	5		9	Y	T8 Y14	8							
9	N	N	N	5		2Y	Y	N	9							
10	N	N	N	6		2Y	Y	N	10							
11	N	N	N	4		2Y	Y	N	11							
12	N	N	N	5		2Y	Y	T9 Y16	12							
13	N	N	N	4		2Y	Y	T10 Y15	13							

Y = neonates present, and criterion has been met: ≥ 20 neonates produced in total by 3rd brood.

N = no neonates

2B = two broods present. 2Y = two broods and criterion met: ≥ 20 neos. by 3rd brood.

X = brood mother dead ae = aborted eggs

✓ or P = neonates present after renewal on previous day (see time in log).

A→ = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted).

acc. = if acclimated, H₂O type used w/ renewal this day.

Test organism collection:

Tray diagram used?

Project #

Symbols (✓ / P)

(Y/N)

Time period, neonates released

Collection date / time

0044476	T		Y	10.2.18/0600 → 10.2.18/1100	10.2.18/1400
	T				
	T				
	T				
	T				
	T				

SAMPLE RECEIPT CHEMISTRY & CHAIN OF CUSTODY DOCUMENTS

NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU
NEB JOB # 05.0044476.00

DATE RECEIVED	10/1/18		10/3/18		10/5/18	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C38-3732	C38-3733	C38-3754	C38-3755	C38-3787	C38-3788
pH (SU)	7.1	7.4	6.7	7.0	7.6	7.5
Temperature (°C)	9.4	7.8	7.3	7.4	3.8	3.8
Dissolved Oxygen (mg/L)	10.4	10.6	10.1	9.9	8.7	9.0
Conductivity (µmhos)	1,039	154	1,106	173	1,272	147
Salinity (ppt)	<1	<1	<1	<1	< 1	< 1
TRC - DPD (mg/L)	0.039	0.015	0.008	0.016	0.010	0.012
TRC - Amperometric (mg/L)	NA	NA	NA	NA	NA	NA
Hardness (mg/L as CaCO ₃)	86	20	84	22	92	18
Alkalinity (mg/l as CaCO ₃)	70	15	70	15	85	15
Tech Initials	CB	CB	TBP	TBP	CW	CW

NOTE: NA = NOT APPLICABLE

Data Reviewed By:

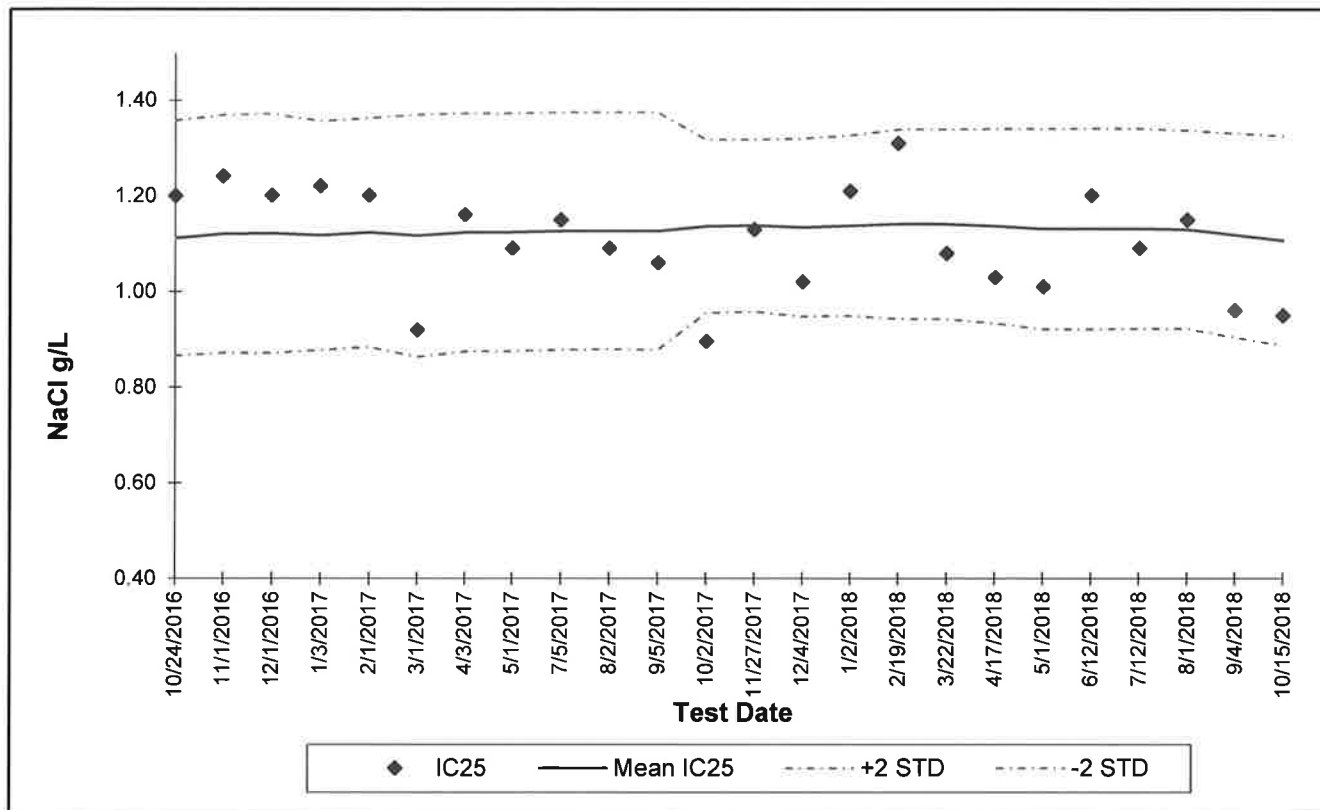


Date Reviewed:

11/1/18

REFERENCE TOXICANT CHARTS

New England Bioassay
Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphnia dubia* Chronic Reproduction IC₂₅



Test ID	Date	IC ₂₅	Mean IC ₂₅	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
16-1553	10/24/2016	1.20	1.11	0.12	0.87	1.36	0.11	14.94	13.79
16-1592	11/1/2016	1.24	1.12	0.12	0.87	1.37	0.11	23.71	14.69
16-1734	12/1/2016	1.20	1.12	0.13	0.87	1.37	0.11	33.62	16.27
17-14	1/3/2017	1.22	1.12	0.12	0.88	1.36	0.11	10.80	15.85
17-151	2/1/2017	1.20	1.12	0.12	0.88	1.36	0.11	7.93	15.28
17-267	3/1/2017	0.92	1.12	0.13	0.86	1.37	0.11	16.70	15.37
17-480	4/3/2017	1.16	1.12	0.12	0.87	1.37	0.11	13.66	15.27
17-616	5/1/2017	1.09	1.12	0.12	0.88	1.37	0.11	8.00	14.84
17-972	7/5/2017	1.15	1.13	0.12	0.88	1.37	0.11	12.67	14.72
17-1146	8/2/2017	1.09	1.13	0.12	0.88	1.38	0.11	23.94	15.20
17-1317	9/5/2017	1.06	1.13	0.12	0.88	1.38	0.11	33.78	16.13
17-1516	10/2/2017	0.90	1.14	0.09	0.95	1.32	0.08	24.47	16.53
17-1787	11/27/2017	1.13	1.14	0.09	0.96	1.32	0.08	19.97	16.69
17-1846	12/4/2017	1.02	1.13	0.09	0.95	1.32	0.08	14.69	16.60
18-10	1/2/2018	1.21	1.14	0.09	0.95	1.33	0.08	10.81	16.36
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64

National 75th Percentile and 90th Percentile CV Averages for *Ceriodaphnia* Reproduction IC₂₅ (EPA 833-R-00-003): 0.45 - 0.62
PMSD Upper and Lower Bounds for *Ceriodaphnia* Reproduction (EPA-821-R-02-013): 13% - 47%

Results:

Sample: Effluent
8J01003-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	70	10	mg/L	10/02/18
Ammonia	5.5	0.2	mg/L	10/02/18
pH	6.9	0.1	SU	10/01/18 18:00
Specific Conductance	998	2	uS/cm	10/02/18
Total Dissolved Solids	420	10	mg/L	10/03/18
Total Organic Carbon	6.8	0.2	mg/L	10/04/18
Total solids (TS)	528	10	mg/L	10/02/18
Total Suspended Solids	5	2	mg/L	10/02/18

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	26.4	0.01	mg/L	10/03/18
Magnesium	4.49	0.01	mg/L	10/03/18
Cadmium	ND	0.0001	mg/L	10/02/18
Lead	0.0004	0.0002	mg/L	10/03/18
Aluminum	0.041	0.012	mg/L	10/03/18
Copper	ND	0.005	mg/L	10/03/18
Nickel	0.003	0.001	mg/L	10/03/18
Zinc	0.046	0.005	mg/L	10/03/18
Total Hardness	84.5	0.0312	mg/L	10/03/18

Sample: Merrimack River
8J01003-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO₃	28	10	mg/L	10/02/18
Ammonia	0.1	0.1	mg/L	10/02/18
pH	6.7	0.1	SU	10/01/18 18:00
Specific Conductance	147	2	uS/cm	10/02/18
Total Dissolved Solids	36	10	mg/L	10/03/18
Total Organic Carbon	6.3	0.2	mg/L	10/04/18
Total solids (TS)	92	10	mg/L	10/02/18
Total Suspended Solids	ND	2	mg/L	10/02/18

Sample: Merrimack River (Continued)
8J01003-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	6.12	0.01	mg/L	10/03/18
Magnesium	1.17	0.01	mg/L	10/03/18
Cadmium	ND	0.0001	mg/L	10/02/18
Lead	0.0009	0.0002	mg/L	10/03/18
Aluminum	0.148	0.012	mg/L	10/03/18
Copper	ND	0.005	mg/L	10/03/18
Nickel	ND	0.001	mg/L	10/03/18
Zinc	ND	0.005	mg/L	10/03/18
Total Hardness	20.1	0.0312	mg/L	10/03/18

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: JIN BOK MCGOWAN
 Title: CHEMIST
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
 Start Date: 09/30/2018 Time: 7:00 AM
 End Date: 10/01/2018 Time: 7:00 AM

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
 Time Collected: _____

Sample Type: _____ Prechlorinated
 _____ X Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge.
(Rt.38)

Requested Analysis: X Chronic and modified acute

RECEIVING WATER

Sampler: THOMAS E. KAWA
 Title: Ops. Supervisor
 Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River
 Date Collected: _____
 Time Collected: _____

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>11:48 AM</u>
Received By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>11:41</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>12:40</u>
Received By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Received By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Received By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Relinquished By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>
Received By: <u>[Signature]</u>	Date: <u>10-1-18</u>	Time: <u>1:54</u>

FOR NEB USE ONLY

* Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory *

Temperature of Effluent Upon Receipt at Lab: 9.4 °C

Temperature of Receiving Water Upon Receipt at Lab: 7.8 °C

Effluent COC# C38-3732

Receiving Water COC# C38-3733

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
 KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

Sample Set #2
NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

EFFLUENT

Sampler: SIN BOK MCDWAN
Title: CHEMIST
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Composite

Sample ID: _____
Start Date: 10-03-2018 Time: 7:00
End Date: 10-03-2018 Time: 7:00

Sampling Method: _____ Grab (for pH and TRC only _____)

Date Collected: _____
Time Collected: _____

Sample Type: _____ Prechlorinated
 X Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge.
(Rt.38)

Requested Analysis: X Chronic and modified acute

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By: [Signature]
Received By: BPachen
Relinquished By: BPachen
Received By: [Signature]
Relinquished By: [Signature]
Received By: Jeffrey B. Pusey

Date: <u>10-3-18</u>	Time: <u>11:50 AM</u>
Date: <u>10-3</u>	Time: <u>11:50</u>
Date: <u>10-3</u>	Time: <u>1427</u>
Date: <u>10-3</u>	Time: <u>1427</u>
Date: <u>10-3-18</u>	Time: <u>1525</u>
Date: <u>10-3-18</u>	Time: <u>1540</u>

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 7.3 °C

Temperature of Receiving Water Upon Receipt at Lab: 7.4 °C

Effluent COC# 038-3754

Receiving Water COC# 038-3755

**IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042**

RECEIVING WATER

Sampler: THOMAS E. KAWA
Title: Ops Superintendent
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River
Date Collected: 10-05-2018
Time Collected: 0730

Sampling Method: _____ **Grab** (for pH and TRC only _____)

Date Collected: _____
Time Collected: _____

Sample Type: _____ Prechlorinated
 X _____ Dechlorinated
 _____ Unchlorinated
 _____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge,
(Rt.38)

Requested Analysis: X Chronic and modified acute

Received
ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Date: 10-5-18	Time: 1:10pm
Date: 10-5	Time: 13:10
Date: 10-5	Time: 1556
Date: 10-5-18	Time: 1556
Date: 10-5-18	Time: 1700
Date: 10/6/18	Time: 0710

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Receiving Water Upon Receipt at Lab. 3.8 °C

Receiving Water COC# 038-3788

**IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042**